



## Recent Perspectives of Diabetic Influence to Osteoporosis and Fracture

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### Abstract

Diabetes and osteoporosis have been highly prevalent. Insulin therapy may increase risk of fracture. According to a cohort study (n=216,624), patients who changed to insulin therapy showed hazard ratio of fractures 1.5, with 1.6/1.8 of hip/vertebral fractures. Elevated hypoglycemic risk may be involved in greater episodes of falls with fractures.

### Keywords

Diabetes, Osteoporosis, Bone Fracture, Bone Mineral Density (BMD), Insulin Therapy

### Abbreviations

BMD: Bone Mineral Density

Diabetes and osteoporosis have been highly prevalent and substantially contributed to the disability burden across the world [1]. T1DM patients have decreased Bone Mineral Density (BMD), while T2DM patients have often increased BMD [2]. In T2DM, obesity increases bone mass but increases fracture rate. This mechanism is due to impaired osteogenesis accompanied by deterioration of bone quality due to increased oxidative stress, deterioration of bone microstructure, promotion of cortical bone porosity, decrease in osteoblast count due to insulin deficiency and continuous exposure to high glucose concentration. Among them, the most common vertebral fractures are accompanied with increased risk of mortality [3].

From the point of general practice, annual study of

ground-level fall was conducted for 1 year with 596 patients [4]. As a result, 23% were aged <15 years, while 29.5% was >60 years. The elderly showed a higher odds ratio 2.51 of sustaining a fracture of a dislocation, and the ratio necessary for major surgical operation was 19.9%.

Concerning the osteopenia in diabetes, several mechanisms are involved. Malnutrition progresses from decreased exercise due to diabetic neuropathy and cerebrovascular disorder, and absorption disorder due to diabetic gastrointestinal disorder, followed by osteopenia. In particular, sarcopenia/flail is a latecomer to diabetes and causes a decrease in cortical bone width [5], which can bring proximal femur fractures. It also increases the fracture rate through decreased physical activity and mechanical stimulation

of bones, increased risk of falls and fractures of the proximal femur during falls due to gluteal muscular atrophy.

The relationship between vertebral fracture risk and diabetes was studied [1]. It included two recent studies with the result of the efficacy of teriparatide and denosumab for reducing vertebral fracture risk in T2DM cases [6,7]. Teriparatide has been effective for reducing fracture risks. From 4 observational studies (n=8828), fracture rates were compared in 4 aspects [7]. They showed that clinical vertebral fractures (CVF), nonvertebral fractures (NVF), clinical fractures (CVF & NVF), hip fracture was 62%, 43%, 50%, 56%, respectively (all  $p < 0.005$ ).

The relationship between T2DM and enhanced risk of bone fracture was investigated, including 138,690 cases from 7 studies [8]. Insulin therapy totally increased risk of fracture for Relative Ratio (RR) 1.24. Results of RR were that men 1.04, female 1.22, hip 1.18, vertebrae 1.28, non-vertebrae 1.06, Europe 1.16, North America 1.24, Asia 1.34. Thus, insulin therapy increased the fracture risk for T2DM in comparison with oral hypoglycemic agents (OHAs).

For cohort study, 216,624 patients were followed for 5 years [9]. The results were that 63% cases changed treatments, and among them 21% changed to insulin (n=28,420). Hazard ratio of fractures was 1.5, with 1.6/1.8 of hip/vertebral fractures, respectively. The events mainly occurred the first 2 months after switching. Consequently, elevated hypoglycemic risk may be involved in greater episodes of fractures [9]. Furthermore, some advantageous perspectives include the clinical situation related to medication switch, complication risks and adherent influence to the prescription [10].

One of the common GLP-1RAs would be liraglutide, which showed unchanged bone resorption for T2DM [11]. In summary, recent topics concerning diabetes and osteoporosis are described. This will hopefully become a suggestion for clinical practice.

### Conflict of Interest

The author has read and approved the final version

of the manuscript. The author has no conflicts of interest to declare.

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